

1. PUBLIC HEALTH STATEMENT

This statement was prepared to give you information about ethylene glycol and to emphasize the human health effects that may result from exposure to it. The Environmental Protection Agency (EPA) has identified 1,416 hazardous waste sites as the most serious in the nation. These sites make up the National Priorities List (NPL) and are the sites targeted for long-term federal clean-up activities. Ethylene glycol has been found in at least 34 of the sites on the NPL. However, we do not know how many of the 1,416 NPL sites have been evaluated for ethylene glycol. As EPA evaluates more sites, the number of sites at which ethylene glycol is found may increase. This information is important for you to know because ethylene glycol may cause harmful health effects and because these sites are potential or actual sources of human exposure to ethylene glycol. Propylene glycol is a chemical that has physical and chemical properties that are similar to ethylene glycol, but it does not cause the same human health effects. Propylene glycol can be used in many of the same products that contain ethylene glycol. Propylene glycol has been identified in at least 5 of the 1,416 NPL sites. The information describing propylene glycol is important for you to know so that you may distinguish between exposure to ethylene glycol and exposure to propylene glycol.

When a chemical is released from a large source, such as an industrial plant, or from a container, such as a drum or bottle, it enters the environment as a chemical emission. This emission, which is also called a release, does not always lead to exposure. You can be exposed to a chemical only when you come into contact with the chemical. You may be exposed to it in the environment by breathing, eating, or drinking substances containing the chemical or from skin contact with it.

If you are exposed to a hazardous chemical such as ethylene glycol, several factors will determine whether harmful health effects will occur and what the type and severity of those health effects will be. These factors include the dose (how much), the duration (how long), the route or pathway by which you are exposed (breathing, eating, drinking, or skin contact),

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the other chemicals to which you are exposed, and your individual characteristics such as age, sex, nutritional status, family traits, lifestyle, and state of health.

1.1 WHAT ARE ETHYLENE GLYCOL AND PROPYLENE GLYCOL?

Ethylene glycol is a synthetic liquid substance that absorbs water. Ethylene glycol is used to make antifreeze and de-icing solutions for cars, airplanes, and boats. It is an ingredient in hydraulic brake fluids and in inks used in stamp pads, ballpoint pens, and print shops. It is a solvent used in the paint and plastics industry, and is used to produce polyester fibers. Other names for ethylene glycol are 1,2-dihydroxyethane, 1,2-ethanediol, 2-hydroxyethanol, ethylene alcohol, glycol, and ethylene dihydrate.

Propylene glycol is also a synthetic liquid substance that absorbs water. Like ethylene glycol, propylene glycol is also used to make polyester compounds, and as a base for de-icing solutions. Propylene glycol is used by the chemical, food, and pharmaceutical industries as an antifreeze when leakage might lead to contact with food. The Food and Drug Administration (FDA) has classified propylene glycol as an additive that is “generally recognized as safe” for use in food. It is used to absorb extra water and maintain moisture in certain medicines, cosmetics, or food products. It is a solvent for food colors and flavors, and in the paint and plastics industries. Propylene glycol is also used to create artificial smoke or fog used in fire-fighting training and in theatrical productions. Other names for propylene glycol are 1,2-dihydroxypropane, 1,2-propanediol, methyl glycol, and trimethyl glycol.

Both ethylene glycol and propylene glycol are clear, colorless, slightly syrupy liquids at room temperature. Either compound may exist in air in the vapor form, although propylene glycol must be heated or briskly shaken to produce a vapor. Ethylene glycol is odorless but has a sweet taste. Propylene glycol is practically odorless and tasteless.

In this profile, ethylene glycol and propylene glycol are discussed together because they have very similar structures and physical properties, and can be used for many of the same

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purposes, although their toxic properties are very different. For more information on the sources, properties, and uses of ethylene glycol and propylene glycol, see Chapters 3 and 4.

1.2 WHAT HAPPENS TO ETHYLENE GLYCOL AND PROPYLENE GLYCOL WHEN THEY ENTER THE ENVIRONMENT?

Waste streams from the manufacture of ethylene glycol and propylene glycol are primarily responsible for the releases of both compounds into the air, water, and soil. Ethylene glycol and propylene glycol can enter the environment when they are used as runway and aircraft de-icing agents. They can also enter the environment through the disposal of products that contain them. Neither compound is likely to exist in large amounts in the air. We have little information about what happens to ethylene glycol and propylene glycol in the air. The small amounts of ethylene glycol and propylene glycol that may enter the air are likely to break down quickly. If either chemical escapes into the air, it will take between 24 and 50 hours for half the amount released to break down. Both compounds can mix completely with water and can soak into soil. Both ethylene glycol and propylene glycol can break down relatively quickly (within several days to a week) in surface water and in soil. Ethylene glycol and propylene glycol can also travel from certain types of food packages into the food in the package. See Chapters 4 and 5 for more information on ethylene glycol and propylene glycol in the environment.

1.3 HOW MIGHT I BE EXPOSED TO ETHYLENE GLYCOL AND PROPYLENE GLYCOL?

The general population can be exposed to ethylene glycol because it is found in common products such as antifreeze, photographic developing solution, coolants, and brake fluid. Ethylene glycol represents a very small part (less than 1%) of photographic developing solutions, so you are not likely to be exposed to it in any significant quantity when using these solutions. If you come into contact with automotive fluids such as antifreeze, coolants, and brake fluid, you may be exposed to ethylene glycol. Ethylene glycol is less than 0.1% of brake fluid, so brake fluid presents little, if any, risk of exposure. People who work in

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industries that use ethylene glycol may be exposed by touching these products or inhaling mists from spraying them. These exposures tend to be at low levels, however. For instance, in areas where de-icing fluids were sprayed, ethylene glycol vapor has been found in the air at low concentrations ranging from less than 0.02 parts per million parts of air (parts per million or ppm) to 4.1 ppm. According to the guidelines set by the American Conference of Governmental Industrial Hygienists (ACGIH), the maximum allowable level of ethylene glycol in workplace air is 50 ppm. Except for operations where ethylene glycol has been sprayed or made into a mist or vapor, exposure to it in the air is unlikely. High doses that could produce harmful effects usually result from intentionally or accidentally eating or drinking a certain amount at one time. The small amounts of ethylene glycol that you might breathe in or get on your skin when using these products are very unlikely to harm you.

Propylene glycol has been approved for use at certain levels in food, cosmetics, and pharmaceutical products. If you eat food products, use cosmetics, or take medicines that contain it, you will be exposed to propylene glycol, but these amounts are not generally considered harmful. People who work in industries that use propylene glycol may be exposed by touching these products or inhaling mists from spraying them. These exposures tend to be at low levels, however. Propylene glycol is used to make artificial smoke and mists for fire safety training, theatrical performances, and rock concerts. These artificial smoke products may also be used by private citizens. These products are frequently used in enclosed spaces, where exposure may be more intense.

See Chapter 5 for more information on exposure to ethylene glycol and propylene glycol.

1.4 HOW CAN ETHYLENE GLYCOL AND PROPYLENE GLYCOL ENTER AND LEAVE MY BODY?

Ethylene glycol or propylene glycol can enter your bloodstream if you breathe air containing mists or vapors from either compound. Both compounds can also enter your bloodstream through your skin if you come in direct contact with them and do not wash them off. If you eat products that contain propylene glycol, it may enter your bloodstream. Exposure of the

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general population to ethylene glycol is usually limited to people who work on cars or use photographic developing solutions. Most fatal ethylene glycol poisonings occur after intentionally eating or drinking it. People and animals can also be poisoned by eating or drinking antifreeze solutions that have not been properly stored or disposed of. Many of the people exposed to ethylene glycol are exposed in their workplaces or while changing antifreeze, brake fluids, or coolants in their cars. However, other people can accidentally be exposed when these auto products are not disposed of properly. Exposure of the general population to propylene glycol is more likely since many foods, drugs, and cosmetics contain it.

Studies of people and animals show that ethylene glycol enters the body quickly and breaks down very quickly. These studies have shown that ethylene glycol is no longer found in urine or body tissues 48 hours after exposure. Propylene glycol breaks down at about the same rate as ethylene glycol. However, studies of people and animals show that if you have repeated eye, skin, nasal, or oral exposures to propylene glycol for a short time, you may develop some irritation.

1.5 HOW CAN ETHYLENE GLYCOL AND PROPYLENE GLYCOL AFFECT MY HEALTH?

Exposure to ethylene glycol can remove water from the tissues in your body and cause loss of body water in the form of urine. If you drink ethylene glycol, it will spread evenly throughout your body within a few hours. Within 24-48 hours of drinking ethylene glycol, much of the compound will be excreted unchanged in the urine and the rest will completely break down so that it can no longer be detected in your body. When ethylene glycol breaks down in the body, it forms chemicals that crystallize; the crystals collect in your body and can affect kidney function. It can also form chemicals that are acidic, thus changing the body's acid/base balance. Swallowing a certain amount of ethylene glycol can kill you. Studies show that swallowing ethylene glycol causes very similar effects in people and animals. The very small amounts of ethylene glycol that could be tasted or otherwise accidentally eaten (for example, by putting your fingers in your mouth) in situations other

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than intentionally or accidentally drinking ethylene glycol are not likely to cause serious illness or death. Moreover, in cases that involve eating or drinking large amounts of ethylene glycol, antidotal treatment after early diagnosis has been very successful.

Propylene glycol breaks down at the same rate as ethylene glycol, although it does not form harmful crystals when it breaks down. Frequent skin exposure to propylene glycol can sometimes irritate the skin.

1.6 ARE THERE MEDICAL TESTS TO DETERMINE WHETHER I HAVE BEEN EXPOSED TO ETHYLENE GLYCOL OR PROPYLENE GLYCOL?

Tests are available to determine if you have been exposed to ethylene glycol. These tests are only used on people who are showing symptoms of ethylene glycol poisoning (but they could be used in other situations). The tests are most often used on people who have intentionally consumed, or who suspect they have consumed, large amounts of ethylene glycol. Recently, tests have been developed that can detect ethylene glycol in blood in 30 minutes. These tests are successful only if you have recently been exposed to large amounts of ethylene glycol. Propylene glycol is generally considered to be a safe chemical, and is not routinely tested for, unless specific exposure, such as to a medicine or cosmetic, can be linked with the observed bad symptoms. Since both ethylene glycol and propylene glycol break down very quickly in the body, they are very difficult to detect even though the symptoms may be present. Refer to Chapters 2 and 6 for more information on these tests.

1.7 WHAT RECOMMENDATIONS HAS THE FEDERAL GOVERNMENT MADE TO PROTECT HUMAN HEALTH?

The government has developed regulations and guidelines for ethylene glycol and propylene glycol. These are designed to protect the public from potential adverse health effects.

The Occupational Safety and Health Administration (OSHA) regulates levels of ethylene glycol in the workplace. The maximum allowable amount of ethylene glycol in workroom air

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is 50 ppm, based on the guidelines of the ACGIH. The EPA has set a drinking water guideline for ethylene glycol of 7,000 micrograms in a liter of water, and has proposed that a release into the environment need not be reported under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA or Superfund) or the Emergency Planning Community Right-to-Know Act unless it exceeds 5,000 pounds within 24 hours.

The Food and Drug Administration (FDA) has classified propylene glycol as “generally recognized as safe,” which means that it is acceptable for use in flavorings, drugs, and cosmetics, and as a direct food additive. According to the World Health Organization, the acceptable dietary intake of propylene glycol is 25 mg of propylene glycol for every kilogram (kg) of body weight. For more information on the regulations and guidelines that apply to ethylene glycol and propylene glycol, see Chapter 7.

1.8 WHERE CAN I GET MORE INFORMATION?

If you have any more questions or concerns, please contact your community or state health or environmental quality department or

Agency for Toxic Substances and Disease Registry
Division of Toxicology
1600 Clifton Road NE, Mailstop E-29
Atlanta, Georgia 30333
(404) 639-6000

This agency can also provide you with the location of the nearest occupational and environmental health clinic. These clinics specialize in the recognition, evaluation, and treatment of illnesses resulting from exposure to hazardous substances.

